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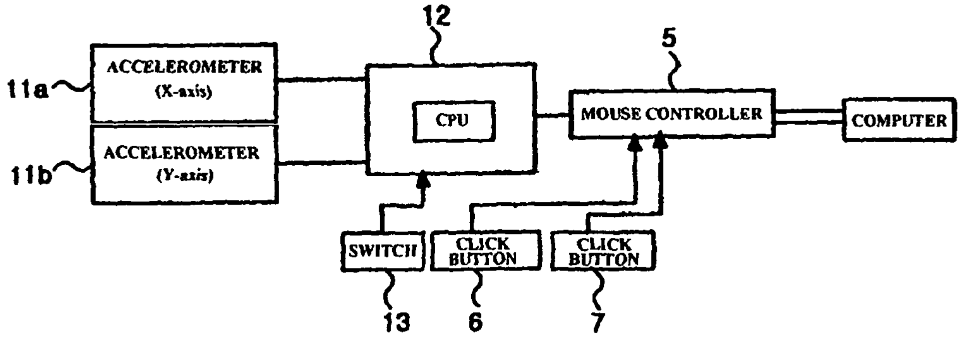
(54) **Title:** POSITION INFORMATION INPUTTING DEVICE USING VARIATION OF DUTY RATIO OF AN ACCELEROMETER



(57) **Abstract:** The present invention relates to a position information inputting device which does not find position by detecting the relative displacement between the main body and a plane by a common ball or optical methods, but provides a device for finding position by sensing a direction of rotation using an accelerometer. The device also provides a means which moves a cursor by computing the pulse value against a certain duty, not by using a regular accelerometer.

POSITION INFORMATION INPUTTING DEVICE USING VARIATION OF DUTY RATIO OF AN ACCELEROMETER

BACKGROUND OF THE INVENTION

FIELD OF THE INVENTION

The present invention relates to a two-dimensional pointing device using a variation of the duty ratio of an accelerometer.

DESCRIPTION OF THE RELATED ART

Generally, a pointing device is to input the position of a cursor on a display screen and a mouse for a computer is a representative example of a pointing device.

In the past, such a pointing device put on a flat portion such as desks; relative displacement between the pointing device and the plane is detected by a ball or optical method, and communication and control from the pointing device to a computer is performed to reflect the displacement to a displacement of the cursor on a screen.

Figure 1 is a view showing an internal construction of a general ball mouse. As shown in the Figure 1, a ball mouse is made to reach the ball 1 on a flat surface and to roll it, whereby the position of the mouse moves by rotation of the ball. In such a ball mouse, a vertical roller 2 and a horizontal roller 3 are located at a 90 degree angle to each other and each of them comes in contact with the ball 1. Therefore, the rollers 2, 3 are rotated by rotation of the ball. Here, the vertical roller 2 corresponds to a vertical movement of the cursor on the display screen and the horizontal roller 3 corresponds to horizontal movement of the cursor.

The rollers 2, 3 are connected to a wheel called an encoder 4, respectively. Therefore, the encoder 4 is rotated by rotation of the rollers. Then, amount of rotation of each encoder 4, that is, a signal proportionate to amount of movement of the mouse occurs and it is delivered to computer through mouse controller 5. The computer receives signals from the mouse and shows the cursor on the location of the corresponding display screen.

On the other hand, one or more click buttons 6, 7 are installed on the top of the ball mouse. When the click buttons 6, 7 are pressed, signals indicative of the clicked states are delivered to computer through mouse controller 5.

However, a mouse as a pointing device so far has weak points.

First, in the case of a ball mouse using a ball, since signals are delivered by mechanical contacts between main body and flat surface, signals can be unsrest according to the condition of the flat surface. Therefore, a good and flat surface is essential for using the mouse and the lifetime of the mouse is shortened due to the mechanical activation of ball, roller or encoder.

Second, an optical mouse using an optical method must use a specifically designed pad, which is very expensive, in order to recognize the sensitivity of the mouse. It is not easy to apply the optical mouse using a specifically designed pad for porrest type computer such as a note-book type of personal computer emphasizing mobility.

Third, a ball mouse, or an optical mouse, must contact the plane and users move the mouse with their arms and wrists, consequently, it needs a greater amount of movement compare to other devices.

Finally, under such conditions that a computer and screen are separate, equipment for transferring pointing information is necessary for doing presentations, etc. An assisting operator for manipulation of the pointing device is necessary and the distance of the operating device is limited.

SUMMARY OF THE INVENTION

An object of the present invention is to provide a pointing device, such as mouse, to resolve such problems as stated above. In other words, the present invention is to provide a pointing device, which does not occor delivery of unsrest signals by mechanical contact, does not affect the lifetime of the device, does not need an expensive specifically designed pad and does not need contact with a flat surface.

In addition, the present invention is moved on a rest (supporting means) or in space, not on a two-dimensional plane. Thus, the present invention enables a pointing device operated by movement of wrists only unlike common pointing devices.

In order to attain the above object, the present invention provides a position information inputting device of a pointing device having one or more click buttons for delivering commands; said input device is comprised of a rotation sensing means for sensing rotation in space, a computing means for computing direction of the rotation by measuring a variation of the duty ratio sensed by the rotation sensing means, and a control means for transmitting the information computed by the computing means and the information whether the click button is being pressed to computer.

The position information inputting device of the present invention may further be comprised of a radio signal conversion means for converting data from the control means into a radio signal and an antenna for transferring the radio signal converted by the radio signal conversion means to computer.

Also, the position information inputting device of the present invention may further be comprised of a reset means that is a set up reference position in space (i.e. the center of display).

The main feature of the present invention is to use an accelerometer of two single-axis or one double-axis in order to generate position and each coordinate in the accelerometers makes a right angle. The feature is to set up locations of display with a certain change of the duty ratio which occurs in the accelerometer, not a digital signal of general pointing devices. The position value and the signal of a click button are formed from the device which are input into computer through a serial port or PS-2 port.

Otherwise, they are input into computer through a radio signal conversion means and an antenna.

In particular, the present invention reduces inconvenience that users feel when they use computers. For example, the present invention enables a user to change a point position in a small space by using change of position. Therefore, the inconvenience that users have to use a mouse frequently and to move the mouse in every direction (i.e. up, down, right and left) on a plane. Indeed, it is possible for them to change a point position by rotation of the wrist.

In another embodiment of the present invention, it is possible to fix a pointing device on a rest (supporting means) and a control point position of the device by rotating the pointing device at any position. Accordingly, inconvenience that many users feel while they are using a mouse, like frequent movement of the mouse and moving of the hands to grab the mouse on the plane within the work space, could be resolved.

Besides, in the case of presentations, it is possible to use an inputting device according to the present invention as a pointing device in space. Users can make a presentation and operate a computer at the same time with the pointing device.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 is a view showing construction of a general ball mouse according to a conventional art.

FIG. 2 is a view explaining a variation of the duty ratio caused by the reference duty ratio signals and rotation, according to the concept of the present invention.

FIG. 3 is a view showing construction of a wire pointing device according to an embodiment of the present invention.

FIG. 4 is a view showing an outline block construction of the wire pointing device shown in FIG. 3.

FIG. 5 is a view showing construction of a wireless pointing device according to another embodiment of the present invention.

FIG. 6 is a view showing an outline block construction of the wireless pointing device shown in FIG. 5.

FIG. 7 is a view showing construction of a wire pointing device using a rest (supporting means) for supporting according to still another embodiment of the present invention.

FIG. 8 is a view showing a construction of a wireless pointing device using a rest (supporting means) for supporting according to still another embodiment of the present invention.

DETAILED DESCRIPTION OF THE INVENTION

First, a basic idea of the present invention will be explained, and an embodiment of the present invention will be described later.

In the present invention, a position can be computed by measuring a variation of the duty ratio of an accelerometer without conversion from an analog signal to a digital signal by an A/D converter.

In other words, the accelerometer, using the MEMS technology, generates signals at a certain period, the duty ratio of which varies in proportion to the rotation value. Figure 2 illustrates a variation of the duty ratio by rotation in one direction against a reference duty ratio under a certain condition. Here, a duty ratio means a ratio of the clock signal at a high level (clock 9) to the one-cycle clock signal (clock 8). It is formulated as clock9/clock8. The direction of rotation is discovered by a variation of the duty ratio by rotation based on the reference duty ratio and sent to the CPU where the size of duty ratio is measured by the internal clock. When the size of the duty ratio is over the set-up one it is interpreted as the requirement of the cursor's movement, and then the cursor moves. In order to stop the movement, a reset switch rotates the device back to the reference position. This is made possible by using direction of rotation only, not by converting the acceleration value of the accelerometer to the position value.

Next, an embodiment of the present invention will be described with reference to the accompanying drawings.

Figure 3 is a view showing a construction of a case where a position information inputting device of the present invention is applied to a wire pointing device, according to an embodiment of the present invention, and Figure 4 is a view showing an outline block construction of the wire pointing device shown in Figure 3.

As illustrated in Figure 3, the wire pointing device according to this embodiment, is equipped with a right, left click button 6, 7, which acts the same as the right and left click button of the common pointing device, an accelerometer (rotation sensing means) 11, which senses rotation, a CPU (computing means) 12, which computes the direction of rotation by measuring a variation of a duty ratio generated from rotation which the accelerometer 11 senses, a mouse controller (control means) 5, composed of a one-chip micro controller, which sends the information computed by the CPU 12 and the information about whether the click button is being used to the computer. This wire pointing device is also equipped with a reset switch 13, which sets up a reference position, for example, a center of the display, in the space.

As illustrated in Figure 4, the accelerometer 11 consists of an accelerometer 11a sensing the rotation of the X-coordinate and the other accelerometer 11b sensing the rotation of the Y-coordinate. Here, the accelerometers 11a and 11b are separated from each other.

The accelerometers 11a and 11b simply computes the direction of rotation by measuring the duty ratio and send it to the mouse controller 5 through the CPU 12.

Figure 5 is a view showing a construction of a wireless pointing device according to another embodiment of the present invention and Figure 6 is a view showing an outline block construction of the wireless pointing device shown in Figure 5.

As illustrated in Figure 5, a wireless pointing device according to this embodiment, is equipped with a right and left click button 6 and 7, which acts the same as the right and left click button of the common pointing device, an accelerometer (rotation sensing means) 11, which senses rotation, a CPU (computing means) 12, which computes the direction of rotation by measuring a variation of the duty ratio generated from the rotation which the accelerometer 11 senses, a mouse controller (control means) 5, composed of a one-chip micro controller, which sends the information computed by the CPU 12 and the information whether the click button is being used to the computer, and a reset switch 13, which sets up a reference position, for example, a center of the display, in the space. Installed also on this wireless pointing device are a RF module 14 and an antenna 15 for sending the data from the mouse controller 5 to the computer.

As illustrated in Figure 6, the accelerometer 11 consists of accelerometer 11a sensing the rotation of the X-coordinate and the other accelerometer 11b sensing the rotation of the Y-coordinate. Here, the accelerometers 11a and 11b are separated from each other.

The accelerometers 11a and 11b simply computes the direction of rotation by measuring the duty ratio and send it to the mouse controller 5 through the CPU 12. The RF module 14 then converts the data to a radio signal, which the antenna 15 sends to the computer.

Figure 7 is a view showing a construction of a wire pointing device of still another embodiment, which is a pointing device using a rest (supporting means) for supporting, where the pointing device 16 is connected to the rest 17 at a certain level. Here, the combination of the pointing device and the rest allows them to move freely in every direction (i.e. up, down, right and left) to the effect of their rotation on the two axes. Rotating this way generates a variation of the duty ratio by rotation, and the detection of this variation by the accelerometer makes possible the determination of the direction of rotation.

Figure 8 is a view showing a construction of a wireless pointing device of still another embodiment of the present invention, which is a pointing device using a rest (supporting means) for supporting, where the pointing device 16 is connected to the rest 17 at a certain level. Here, the combination of the pointing device and the rest also allows them to move freely in all directions (i.e. up, down, right and left) to the effect of their rotation on the two axes. Rotating this way generates a variation of the duty ratio by rotation, and the direction of rotation is determined by the detection of this variation by the accelerometer. The antenna at the front of the pointing device sends this signal to the computer.

In the above embodiments, especially the wireless pointing device, as a device not restricted by distance or space, could come in handy when doing such work as a presentation.

Additional advantages and modifications will readily occur to those skilled in the art. Therefore, the invention in its broader aspects is not limited to the specific details and representative embodiments shown and described herein. Accordingly, various modifications may be made without departing from the spirit or scope of the general inventive concept as defined by the appended claims and their equivalents.

As mentioned above, because a position information inputting device of the present invention can be used not only at a fixed position but in any space, it can perform an accurate pointing control in a restricted space such as on an airplane or in a moving vehicle. And because it can be used being fixed to a rest (supporting means), the need of complicated movements of arms is eliminated; two-dimensional space is not required; and the user himself can operate the computer during a presentation. Moreover, a wireless embodiment is beyond the restriction of space.

What is claimed is:

1. A position information inputting device of a pointing device having one or more click buttons for delivering commands, comprising:

a rotation sensing means for sensing rotation in space,

a computing means for computing direction of the rotation by measuring a variation of the duty ratio generated from the rotation, which the rotation sensing means senses, and

a control means for transmitting the information computed by the computing means and the information whether the click button is being pressed to computer.

2. The position information inputting device according to claim 1, further comprising a radio signal conversion means for converting the data from the control means to a radio signal, and

an antenna for transmitting the radio signal converted by the radio signal conversion means to the computer.

3. The position information inputting device according to claims 1 or 2, wherein the inputting device is used by being fixed at a certain level by a supporting means.

4. The position information inputting device according to claims 1 or 2, further comprising a reset means for setting a reference position in space.

5. The position information inputting device according to claim 3, further comprising a reset means for setting a reference position in space.

Fig. 1

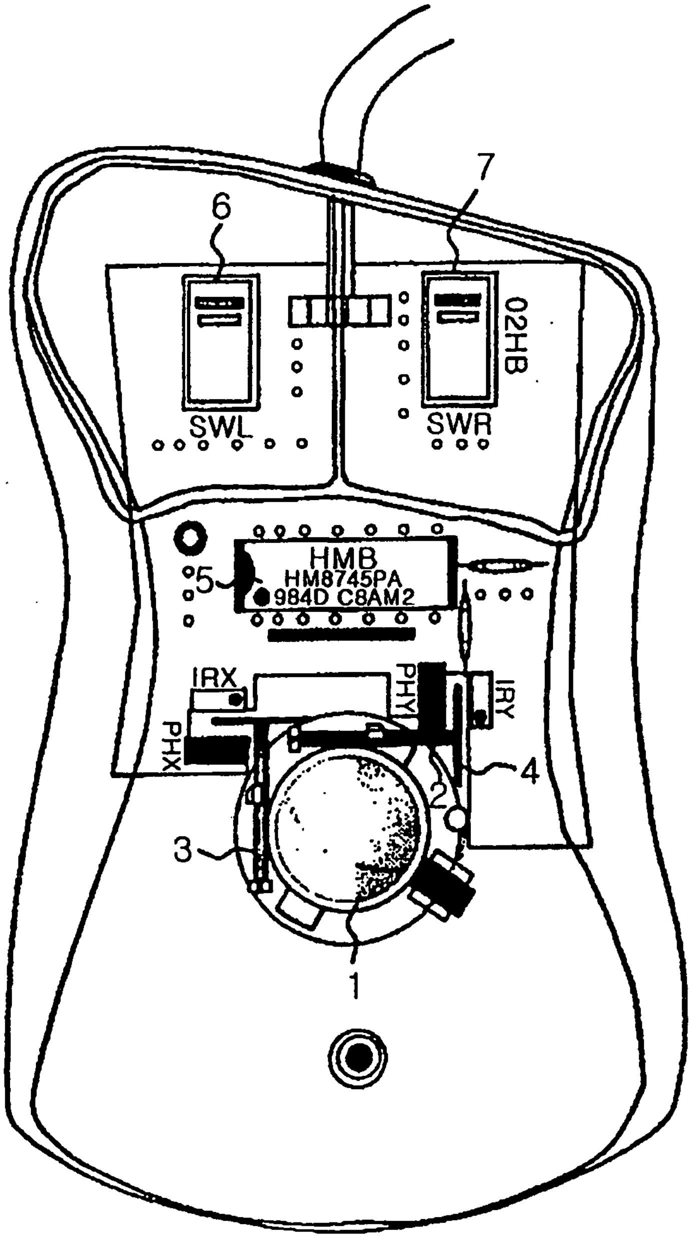


Fig. 2

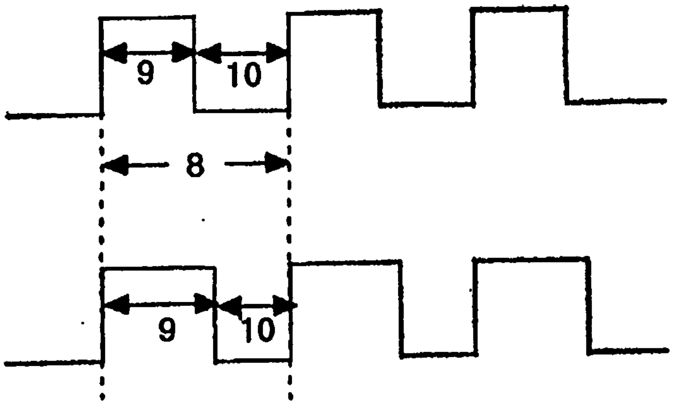


Fig. 3

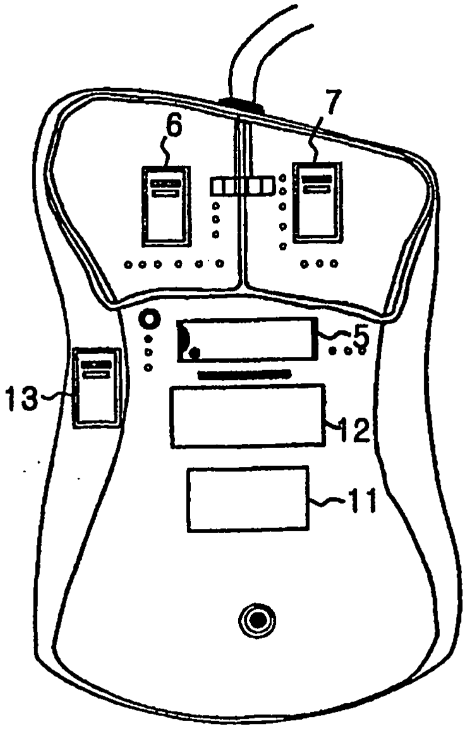


Fig. 4

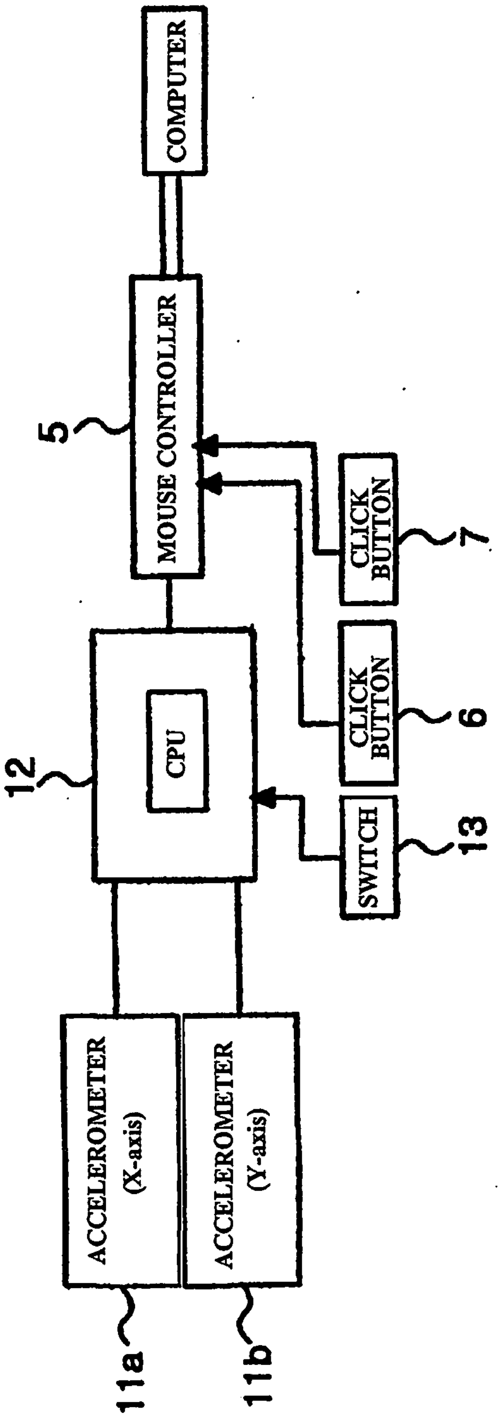

COMPUTER
MOUSE CONTROLLER
5
CLICK BUTTON
7
CLICK BUTTON
6
CPU
12
SWITCH
13
ACCELEROMETER (X-axis)
ACCELEROMETER (Y-axis)
11a
11b

Fig. 5

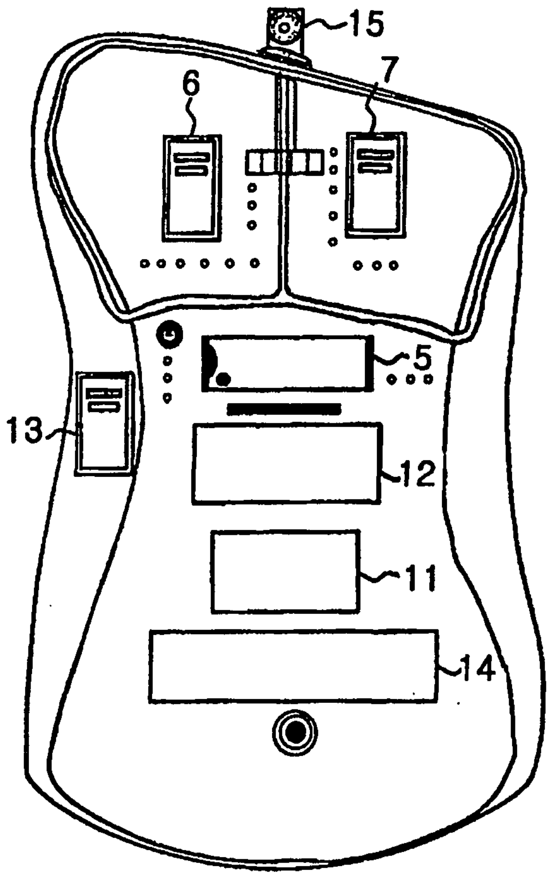


Fig. 6

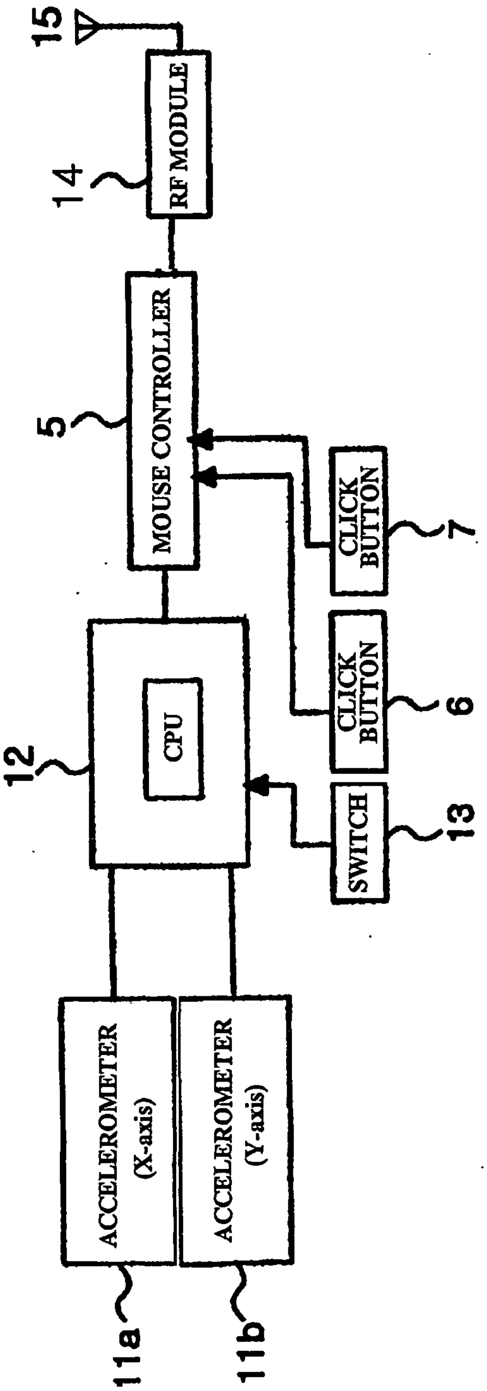

15
RF MODULE
14
MOUSE CONTROLLER
5
CLICK BUTTON
7
CLICK BUTTON
6
CPU
12
SWITCH
13
ACCELEROMETER (X-axis)
11a
ACCELEROMETER (Y-axis)
11b

Fig. 7

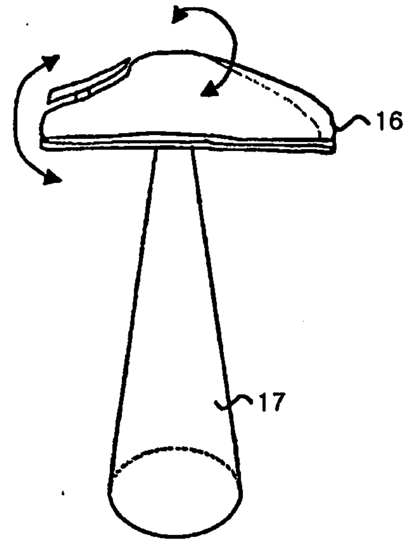
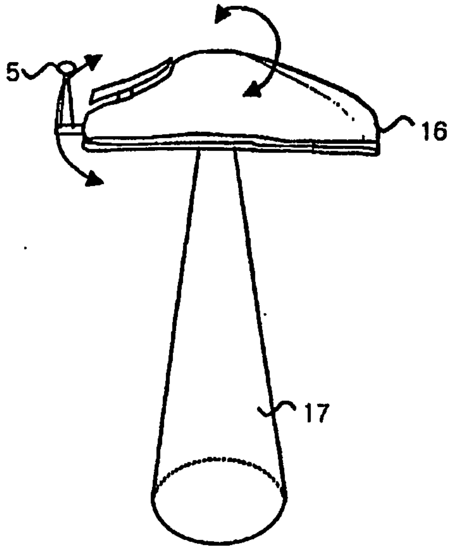


Fig. 8



INTERNATIONAL SEARCH REPORT

International application No.
PCT/KR00/00788

A. CLASSIFICATION OF SUBJECT MATTER

IPC7 G06F 3/033

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimun documentation searched (classification system followed by classification symbols)

KOREAN PATENTS AND APPLICATIONS FOR INVENTIONS SINCE 1975, KOREAN UTILITY MODELS AND APPLICATIONS FOR UTILITY MODELS SINCE 1975, JAPANESE PATENTS AND APPLICATIONS FOR INVENTIONS SINCE 1975

Documentation searched other than minimun documentation to the extent that such documents are included in the fileds searched

KR: G06F 1/00, 3/00

Electronic data base consulted during the intertnational search (name of data base and, where practicable, search trerms used)

JAPIO, USPATFULL, PAJ

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	KR 90-8691 Y (HUNAMOTO YASUO, KASII MASAHARU) 22 SEPTEMBER 1990 see entire document	1-5
A	KR 98-40472 A (DAEWOO CORP.) 17 AUGUST 1998 see entire document	1-5
A	KR 99-239346 B (LG CORP.) 20 OCTOBER 1999 see entire document	1-5

☐ Further documents are listed in the continuation of Box C.

☐ See patent family annex.

* Special categories of cited documents:

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